



Algebra and Functions

14 questions	12 questions	17 questions	17 questions	8 questions	12 questions
Number Sense	Statistics, Data Analysis, Probability	Algebra and Functions	Measurement and Geometry	Math Reasoning	Algebra I

Seventeen of the 80 CAHSEE multiple-choice questions are based on 10 selected standards of the grade 7 Algebra and Functions strand.

WHAT DO THE ALGEBRA AND FUNCTIONS STANDARDS ASK ME TO DO?

To answer the CAHSEE Algebra and Functions questions, you'll need to know how to:

- generalize numerical and geometric patterns
- use a table, graph, or symbolic rule to represent the generalization of a pattern
- compare different forms of representations
- know the difference between a relation and a function
- solve linear equations

Vocabulary

The words below have appeared on the CAHSEE during past administrations. If any of these words are unfamiliar to you, look them up in the CAHSEE Math Vocabulary list in the appendix at the back of this Study Guide, or check with your math teacher.

expression

slope

y -intercept

parallel

x -intercept

WHY ARE ALGEBRA AND FUNCTIONS IMPORTANT?

Many entry-level technical, scientific, and health-related jobs require additional training beyond high school. To qualify for additional training for these higher-paying jobs, you need to know the basics of algebra. You can keep your career and college options open by mastering algebra basics while you are in high school.

The CAHSEE questions focus mainly on the basic algebra skills necessary to deal with graphs, formulas, linear functions, and equation solving. In fact, the Algebra and Function standards, together with the Algebra I standards, cover the exact same classic algebra topics that students in the United States have studied for more than one hundred years!

HOW WILL THE CAHSEE TEST MY KNOWLEDGE OF ALGEBRA AND FUNCTIONS?

The CAHSEE tests 10 of the 13 grade 7 standards from the Algebra and Functions strand. Each box that follows contains one of the standards, a sample question based on that standard, and an explanation of the question's solution.

7AF1.1 Use variables and appropriate operations to write an expression, an equation, an inequality, or a system of equations or inequalities that represents a verbal description (e.g., three less than a number, half as large as area A). [2 questions]

Sample CAHSEE Question

Which of the following inequalities represents the statement, “A number x , decreased by 13 is less than or equal to 39”?

A $13 - x \geq 39$

B $13 - x \leq 39$

C $x - 13 \leq 39$

D $x - 13 < 39$

M03049

Mathematical Solution

- A number x , decreased by 13 should be written as $x - 13$.
- Less than or equal to 39 should be written as ≤ 39 .
- Combining these two parts, you get $x - 13 \leq 39$. Therefore, the correct answer is **C**.

Descriptive Solution

The first part of the sentence says “A number x , decreased by 13.” Other ways of saying this that are commonly used in math textbooks include “13 less than a number x ” or “the difference between a number x and 13” or “take away 13 from a number x .” All of these phrases are written algebraically as “ $x - 13$.” The second part of the sentence, “is less than or equal to 39,” would be written algebraically as “ ≤ 39 .” Therefore, the correct answer is **C**: $x - 13 \leq 39$.

7AF1.2 Use the correct order of operations to evaluate algebraic expressions such as $3(2x + 5)^2$. [1 question]

Sample CAHSEE Question

If $h = 3$ and $k = 4$, then $\frac{hk + 4}{2} - 2 =$

- A 6
- B 7
- C 8
- D 10

M00052

Mathematical Solution

- $\frac{3 \cdot 4 + 4}{2} - 2 = ?$
- $\frac{12 + 4}{2} - 2 = ?$
- $\frac{16}{2} - 2 = ?$
- $8 - 2 = 6$
- Therefore, the correct answer is **A**.

Descriptive Solution

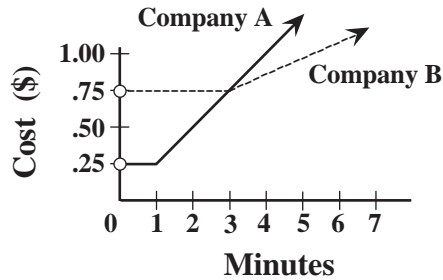
The correct answer is **A**, 6. To simplify expressions, you need to use the proper algebraic order of operations: multiplication and division must be done before addition and subtraction. Substituting 3 for “ h ” and 4 for “ k ” in the expression gives the following as the solution.

$$\frac{3 \cdot 4 + 4}{2} - 2 = \frac{12 + 4}{2} - 2 = \frac{16}{2} - 2 = 8 - 2 = 6$$

7AF1.5 Represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in the situation represented by the graph. [3 questions]

Sample CAHSEE Question

The cost of a long distance call charged by each of two telephone companies is shown on the graph below.



Company A is less expensive than Company B for—

- A all calls.
- B 3 minute calls only.
- C calls less than 3 minutes.
- D calls longer than 3 minutes.

M02840

Mathematical Solution

- The correct answer is **C**. Please refer to the next column for a description of the solution.

Descriptive Solution

The graph shows that, for all calls lasting less than three minutes, Company B charges a flat rate of 75¢. But for these calls, Company A's prices are all under 75¢. For calls longer than 3 minutes, Company B's prices are cheaper. So, the correct answer is **C**.

7AF2.1 Interpret positive whole-number powers as repeated multiplication and negative whole-number powers as repeated division or multiplication by the multiplicative inverse. Simplify and evaluate expressions that include exponents. [1 question]

Sample CAHSEE Question

$x^3y^3 =$

- A $9xy$
- B $(xy)^6$
- C $3xy$
- D $xxxyyy$

M02879

Mathematical Solution

- $x^3 = xxx$
- $y^3 = yyy$
- Combining these parts, you get $xxxyyy$.
- Therefore, the correct answer is **D**.

Descriptive Solution

Raising a number to the third power means multiplying the number by itself three times. For example,
 $5^3 = (5)(5)(5) = 25(5) = 125$. For any number x , $x^3 = xxx$. Therefore, the correct answer is **D**, $xxxyyy$.

7AF2.2 Multiply and divide monomials; extend the process of taking powers and extracting roots to monomials when the latter results in a monomial with an integer exponent. [1 question]

Sample CAHSEE Question

Simplify the expression shown below.

$$(6a^4bc)(7ab^3c)$$

- A $13a^4b^3c$
- B $13a^5b^4c^2$
- C $42a^4b^3c$
- D $42a^5b^4c^2$

M02109

Mathematical Solution

$$= 6(7)a^4abb^3cc$$

$$= 42a^{4+1}b^{1+3}c^{1+1}$$

$$= 42a^5b^4c^2$$

- Therefore, the correct answer is **D**.

Or

$$= (6aaaaabc)(7abbbbc)$$

$$= 42aaaaabbbbcc$$

$$= 42a^5b^4c^2$$

- Therefore, the correct answer is **D**.

Descriptive Solution

You may use the exponent rule that allows the addition of the powers when the bases are multiplied or the correct answer for this question may be even easier to see if we write out the expression using expanded notation like this:

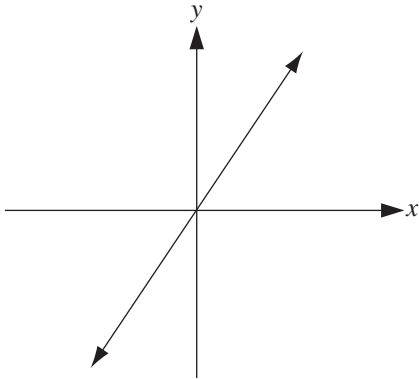
$$(6a^4bc)(7ab^3c) = (6aaaaabc)(7abbbbc) = 42aaaaabbbbcc = 42a^5b^4c^2, \text{ which is choice D.}$$

7AF3.1 Graph functions of the form $y = nx^2$ and $y = nx^3$ and use in solving problems.
[1 question]

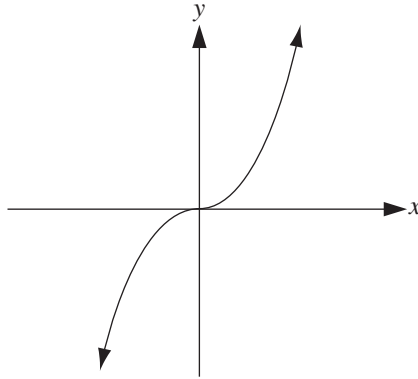
Sample CAHSEE Question

Which of the following could be the graph of $y = x^3$?

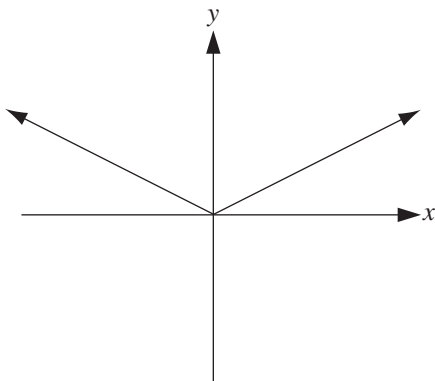
A



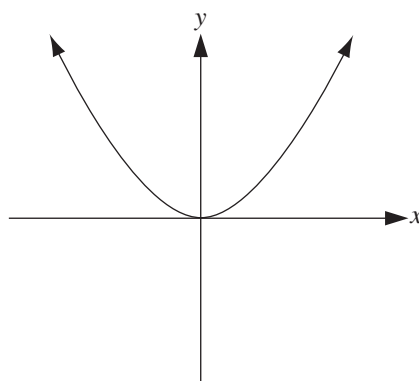
C



B



D



M02200

Mathematical Solution

- The correct answer is **C**. Please refer to the next column for a description of the solution.

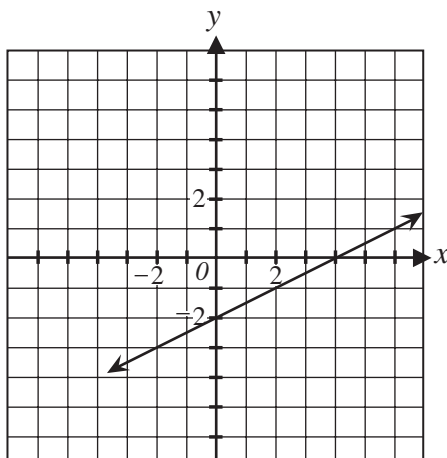
Descriptive Solution

The correct answer is **C**. The other graphs shown may also be familiar to you. Option A is the graph of a linear function, such as $y = nx$. Option B is the graph of an absolute value function such as $y = |nx|$. Option D might be the graph of a parabola such as $y = nx^2$.

7AF3.3 Graph linear functions, noting that the vertical change (change in y -value) per unit of horizontal change (change in x -value) is always the same and know that the ratio (“rise over run”) is called the slope of a graph. [2 questions]

Sample CAHSEE Question

What is the slope of the line shown in the graph below?



- A -2
- B $-\frac{1}{2}$
- C $\frac{1}{2}$
- D 2

M02556

Mathematical Solution

- Find the slope of the line by choosing two points. For example $(0, -2)$ and $(4, 0)$.
- The slope = $\frac{\text{rise}}{\text{run}}$.

$$\begin{aligned}
 &= \frac{(y\text{-coordinate of first point}) - (y\text{-coordinate of second point})}{(x\text{-coordinate of first point}) - (x\text{-coordinate of second point})} \\
 &= \frac{(-2) - (0)}{(0) - (4)} \\
 &= \frac{-2}{-4} \\
 &= \frac{1}{2}
 \end{aligned}$$

- Therefore, the correct answer is **C**.

Descriptive Solution

The slope of the line shown in this graph can be found by first choosing any two points on the line. For this graph, the y -intercept, at $(0, -2)$, and the x -intercept, at $(4, 0)$, will work nicely. If we move from the first point to the second, what is the net vertical change? The change in y -coordinates, from -2 to 0 , is a rise of 2 units. And what is the horizontal change? Going from an x -coordinate of 0 over to 4 is a horizontal run of 4 units.

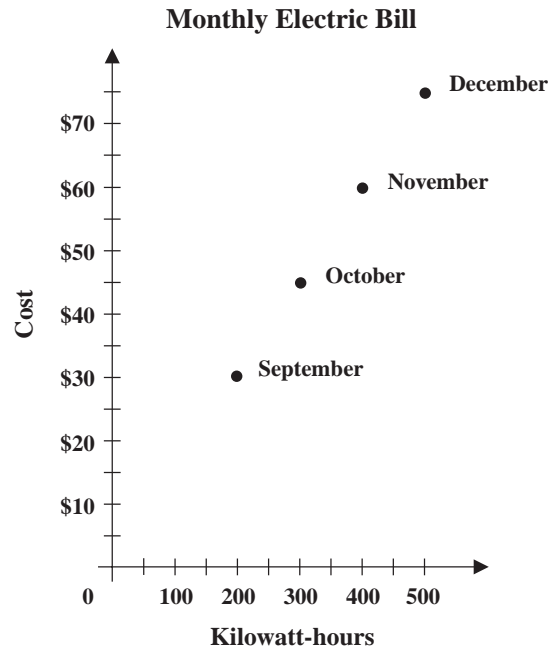
7AF3.3 Sample CAHSEE Question cont'd

The slope of the line is the ratio of the vertical rise to the horizontal run, which is $\frac{2}{4} = \frac{1}{2}$; therefore, the correct answer is **C**. Notice that this ratio always reduces to $\frac{1}{2}$ no matter which two points on the line are used.

7AF3.4 Plot the values of quantities whose ratios are always the same (e.g., cost to the number of an item, feet to inches, circumference to diameter of a circle). Fit a line to the plot and understand that the slope of a line equals the quantities. [1 question]

Sample CAHSEE Question

The graph below shows Francine’s electric bill for 4 different months. What is the price per kilowatt-hour of Francine’s electricity?



- A \$0.15
- B \$0.30
- C \$1.50
- D \$6.67

M02681

Mathematical Solution

- Verify that the given points form a line.
- Find the slope of the line by choosing two points. For example $(200, 30)$ and $(300, 45)$.
- The slope = $\frac{\text{rise}}{\text{run}}$.

$$= \frac{(\text{y-coordinate of first point}) - (\text{y-coordinate of second point})}{(\text{x-coordinate of first point}) - (\text{x-coordinate of second point})}$$

$$= \frac{(45) - (30)}{(300) - (200)}$$

Descriptive Solution

The slope of a line equals the change in rise over the change in run. For example, from October to September, the change in rise (the vertical or y-axis marked “Cost”) is 15 $(45 - 30)$ and the change in run (the horizontal or x-axis marked “Kilowatt-hours”) is

7AF3.4 Sample CAHSEE Question cont'd

$$= \frac{15}{100}$$

$= 0.15$, which is equivalent to \$0.15.

- Therefore, the correct answer is **A**.

Or

- Verify that the given points form a line.
- Choose one of the given points, for example $(200, 30)$.
- Since the question is asking for “price per kilowatt-hour,” take $\$30 \div 200$ kilowatt-hours.
 $= 0.15$, which is equivalent to \$0.15.
- Therefore, the correct answer is **A**.

100 $(300 - 200)$.

Therefore, the slope of the line is 0.15,

or $\frac{15}{100}$. You will

get this same number if you calculate the slope from November to October and from December to November. Because the data points for each month form a straight line, you know that the slope of the line is constant and that the price per kilowatt-hour is the same for each month. Therefore, you can use just one of the data points to calculate the answer.

The data point for September falls over the number 200 on the x -axis labeled “Kilowatt-hours,” so you know that Francine used 200 kilowatt-hours during this month. To determine Francine’s electric bill for September, you must trace the data point for September to the vertical line, or y -axis, which is marked “Cost.” The data point is aligned with \$30, so you can see that Francine spent \$30 to use 200 kilowatt-hours in September. To determine the cost of each kilowatt-hour, divide the cost by the number of kilowatt-hours

$$\left(\frac{30}{200} = 0.15 \right).$$

Therefore, the correct answer is **A**.

7AF4.1 Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results. [3 questions]

Sample CAHSEE Question

Solve for x .

$$2x - 3 = 7$$

A -5

B -2

C 2

D 5

M02771

Mathematical Solution

$$2x - 3 = 7$$

$$\begin{array}{r} +3 \quad +3 \\ \hline \end{array}$$

$$2x = 10$$

$$\frac{2x}{2} = \frac{10}{2}$$

$$x = 5$$

- Therefore, the correct answer is **D**.

Descriptive Solution

Notice that this is a “two step” equation. You could solve the equation by first adding 3 to both sides, and then dividing both sides by 2. Another way is to check each of the answers to see which one makes the equation true. If you put 5 into the left-hand side of the equation, then $2(5) - 3 = 7$. So, the correct answer is **D**: 5.

7AF4.2 Solve multistep problems involving rate, average speed, distance, and time or a direct variation. [2 questions]

Sample CAHSEE Question

Stephanie is reading a 456-page book. During the past 7 days she has read 168 pages. If she continues reading at the same rate, how many more days will it take her to complete the book?

- A 12
- B 14
- C 19
- D 24

M00380

Mathematical Solution

- Find the rate:
 $168 \div 7 = 24$ pages per day.
- Find the number of pages she has left to complete the book:
 $456 - 168 = 288$ pages.
- Find the number of days left to complete the book:
 $288 \div 24 = 12$ days.
- Therefore, the correct answer is **A**.

Or

- Set up a proportion:
 $\frac{7}{168} = \frac{x}{456}$, where x represents the total number of days needed to read 456 pages.
 $168x = 7(456)$
 $168x = 3192$
 $\frac{168x}{168} = \frac{3192}{168}$
 $x = 19$ days
- Then subtract the number of days she has read the book so far, from the total number of days needed to read 456 pages: $19 - 7 = 12$.
- Therefore, the correct answer is **A**.

Descriptive Solution

You can do this problem without algebra. Notice that because Stephanie read 168 pages in seven days, she is averaging 24 pages per day. There are $456 - 168 = 288$ pages left to read. So at a rate of 24 pages a day, how long will it take Stephanie to read the remaining 288 pages? Well, 288 divided by 24 = 12 days. So the correct answer is **A**. You could do this problem using algebra by setting up a proportion $\frac{7}{168} = \frac{x}{456}$. Solving for x you get 19 days total to read the book. But because Stephanie has already read for seven days, she'll have to read for 12 more days to finish.

Now that you've seen the 10 Algebra and Functions standards and read the solutions to some of the CAHSEE questions, it's time for you to answer the questions in the next section and then check your answers using the answer key provided in the appendix at the back of this Study Guide.

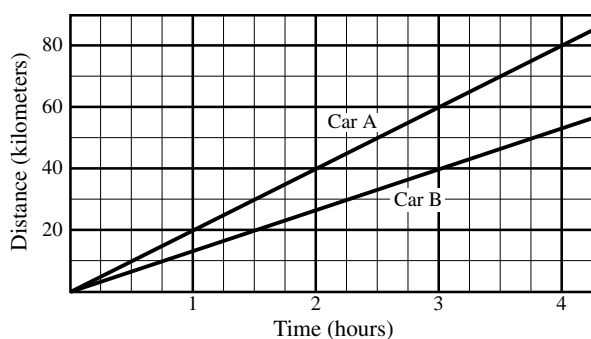
(Note: The CAHSEE questions used as examples throughout this Study Guide and in the following sample questions were used on prior CAHSEEs. These items will not be used in future CAHSEEs.)

ADDITIONAL ALGEBRA AND FUNCTIONS SAMPLE QUESTIONS

1. A shopkeeper has x kilograms of tea in stock. He sells 15 kilograms and then receives a new shipment weighing $2y$ kilograms. Which expression represents the weight of the tea he now has?

A $x - 15 - 2y$
 B $x + 15 + 2y$
 C $x + 15 - 2y$
 D $x - 15 + 2y$

M00110



2. After three hours of travel, Car A is about how many kilometers ahead of Car B?

A 2
 B 10
 C 20
 D 25

M00066

3. Simplify the expression shown below.

$$(5x^2z^2)(8xz^3)$$

A $40x^2z^6$
 B $40x^3z^5$
 C $40x^3z^6$
 D $40x^5z^5$

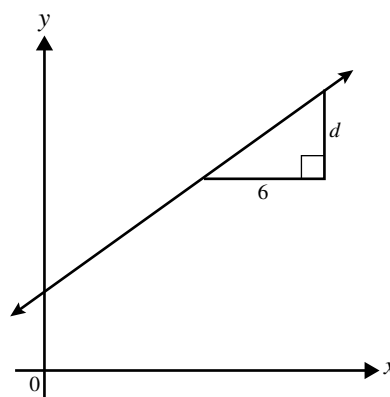
M02009

4. $\sqrt{4x^4} =$

A 2
 B $2x$
 C $4x$
 D $2x^2$

M03067

5. The slope of the line shown below is $\frac{2}{3}$.



What is the value of d ?

A 3
 B 4
 C 6
 D 9

M02078

6. Solve for n .

$$2n + 3 < 17$$

A $n < 2$
 B $n < 3$
 C $n < 5$
 D $n < 7$

M02040

7. In the inequality $2x + \$10,000 \geq \$70,000$, x represents the salary of an employee in a school district. Which phrase most accurately describes the employee's salary?
- A At least \$30,000
 - B At most \$30,000
 - C Less than \$30,000
 - D More than \$30,000
8. Robert's toy car travels at 40 centimeters per second (cm/sec) at high speed and 15 cm/sec at low speed. If the car travels for 15 seconds at high speed and then 30 seconds at low speed, what distance would the car have traveled?
- A 1050 cm
 - B 1200 cm
 - C 1425 cm
 - D 2475 cm

M02621

M10748